EPIDEMIOLOGICAL SURVEY OF ENDEMIC GOITRE AND ENDEMIC CRETINISM

AN ICMR TASK FORCE STUDY

INDIAN COUNCIL OF MEDICAL RESEARCH
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FOREWORD

The existence of goitre in India has been known since ages, as reported in ancient literature. The problem continues to exist and especially so in the Sub-Himalayan belt. Conventionally, it has been thought that the problem of goitre was localised to the foot-hills of the Himalayas. Recent studies, however, have shown that there are pockets with goitre in other parts of the country too. As you may be aware, the Government of India has already taken the decision for universal iodisation of salt by the year 1992. It, therefore, became necessary to make an assessment of the prevalence of Iodine Deficiency Disorders in different geographical terrains of the country. The Council, through its Task Force strategy, conducted this multicentric study in 14 districts in 9 states of India.

This study clearly indicates that the prevalence of goitre is not only restricted to the Himalayan belt of India, as was formerly thought, but the condition of iodine deficiency is widely prevalent in the plains, plateaux, riverine areas and near the sea-coast. Therefore, this study supports the decision taken by the Government of India to universally iodise edible salt in the country by the year 1992.

We hope that this report would be useful to the programme managers, health administrators and health personnel for the control of Iodine Deficiency Disorders in the country.

A.S. Paintal
Director General

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1. Introduction

Iodine deficiency, manifested by endemic goitre and cretinism, continues to be a public health problem of concern in India. Inspite of its recognition as the cause of crippling disorders affecting millions of people in the Sub-Himalayan region, and the subsequent implementation of a National Goitre Control Programme which has been in operation for almost 20 years, the problem continues unabated. In fact, recent surveys in different regions of the goitre belt have confirmed the continued existence of the problem in the known endemic areas. More alarming is the finding of moderate to high prevalence of endemic goitre in other parts of India outside the Sub-Himalayan region, where its existence was never suspected. The need for a well planned all-India survey to reassess the extent and magnitude of the problem is obvious. It is now estimated that about 60 million people are affected by these disorders in India and not less than 150 million people in the endemic areas are exposed to these risks.

Recent investigations have demonstrated conclusively that deficiency of iodine in the human body not only leads to endemic goitre and cretinism, but to a very large number of disorders starting from the intra-uterine stage of human life and continuing till the adult age. Abortion, still birth and various degrees and types of neuro-motor dysfunctions are produced by iodine deficiency in the human body. It is unfortunate that even now endemic goitre and cretinism are regarded as the only manifestations of iodine deficiency and that other serious manifestations which affect the growth and development and subsequently quality of life of man are not even recognised by either the medical or health professions or by policy makers and senior administrators. Endemic goitre and cretinism are only the tip of the "IDD iceberg." There is an urgent need to recognise the problem of iodine deficiency in its true perspective and take immediate and appropriate steps to eradicate the same.

Iodine, a trace element essential for human nutrition, is present in foods and water, and the daily requirement of 130—150 micro grams per day is easily obtained through these two sources. However, when there is environmental iodine deficiency characterised by iodine poor soil, the amount of iodine in foods, either animal or vegetable, and in drinking water, becomes highly deficient resulting in iodine deprivation of all those living in that region. Conventionally, soils exposed to millions of years of iodine leaching of the soil due to glaciation and repeated washing due to floods are deficient in iodine. Slopes of mountains and hills are thus the conventional IDD endemic areas. The Sub-Himalayan region of India known as the goitre belt of India, extending along the northern border of the country from east to west is a glaring example of such iodine deficient environment. The extension of this mountain range towards the west as the Hindukush Range in Pakistan and Afghanistan has similar areas with alarming prevalence of iodine deficiency disorders.

There is now increasing evidence that environmental iodine deficiency is not only restricted to the mountainous and hilly areas and that similar leaching of iodine from the

soil is possible on its exposure to recurrent flooding, heavy rainfall and even with certain geochemical properties of the soil. Endemic areas have been identified in riverine and delta areas of Bangladesh and Burma exposed to recurrent seasonal flooding. Deep wells have been located in many countries with extremely low iodine content of their water, due presumably to soil characteristics. Endemic areas with high prevalence of goitre have been located in oases in the deserts of Egypt and Libya. Ad hoc studies in India in various regions do indicate that endemic goitre and cretinism are prevalent in plains, riverine areas, plateaus and even in coastal areas.

The National Goitre Control Programme, based on iodated salt, has been in operation in India for more than 20 years in the Sub-Himalayan region. Due to a number of logistic and administrative falterings, the impact of the Programme was far from satisfactory. In view of the urgency in controlling the IDD menace and in order to overcome the loop-holes identified in the existing programme, the Government of India took the heroic decision of adopting Universal Iodation of Salt in contrast to the targetted approach as at present. Through several stages, production of iodated salt will be stepped up in the country, in both private and public sectors, till the target year of 1992, when all edible salt in the country, totalling about 5 million metric tonnes will be in iodated form. But till that time, both iodated and non-iodated salts will be available in the country, and obviously distribution of iodated salt will have to be restricted in priority areas with severe iodine deficiency.

It was felt that a carefully controlled survey should be conducted in the country to assess the prevalence of the problem not only in the conventional goitre belt, which is already known, but in other representative areas throughout the country to identify areas where the prevalence rate is high needing immediate supply of iodated salt.

1.01 Earlier prevalence studies

Sir Robert McCarrison was the pioneer in conducting studies to determine the prevalence of endemic goitre in India. For nearly three decades starting in the beginning of the century, he conducted laborious field and laboratory studies to unravel the etiology of endemic goitre and cretinism and concluded that it was a disease of complex etiology being related to infection with the coliform group of intestinal organisms and to faulty and unbalanced diets. His historical studies in the Gilgit and Chitral districts, situated in the Hindukush range in the northern part of the Indian Sub-Continent and now belonging to Pakistan, showed that in some of the villages in those districts, endemic goitre was so common that it was difficult to find a man, woman or child not having this deformity.

The facts emerging from his study are the marked association of goitre with regions of high mountains, and comparatively limited prevalence in temperate and sub-tropical zones. He also found that polluted water was an important cause for the incidence of endemic goitre.

In subsequent years, Stott studied four endemic areas in the then United Provinces. He observed that the endemic villages were located in the hot moist river valleys where

maize was being cultivated. Deaf mutes and cretins were also observed by him in these areas. The prevalence of goitre and cretinism was found to be alarming in the Padrauna tehsil of Gorakhpur district. In later years, Stott and Gupta continued to study the super-endemic areas of Gorakhpur and Gonda districts. They observed that in severely affected areas of Padrauna, the prevalence rate of endemic goitre was as high as 90%. In Padrauna area, goitre was also observed among animals and birds. They established that the incidence of goitre was highly correlated with factors like education, wealth, gender, family and season. However, they could not establish any conclusive association between goitre endemia and the type of soil in the affected areas.

In 1950s the Government of India, in collaboration with the Government of Punjab and the Indian Council of Medical Research (ICMR) conducted a survey in the Kangra valley in three zones in order to assess the impact of iodised salt. The initial survey before distribution of iodised salt was carried out in 1956 and the impact was studied in 1962. The data revealed that the prevalence rates of endemic goitre were significantly reduced in the areas getting either potassium iodide or potassium iodate, clearly demonstrating the effectiveness of iodine for the control of endemic goitre. Subsequently, the survey team of the National Goitre Control Programme of the Directorate General of Health Services conducted ad-hoc surveys at periodic intervals in the demarcated endemic areas of the Sub-Himalayan regions in the different States.

1.02 Prevalence studies outside Sub-Himalayan region

In the last two decades, a number of studies conducted in different parts of the country outside the conventional goitre belt indicated the presence of iodine deficiency disorders in localised regions, pockets and among certain groups of population. A survey of endemic goitre in several villages of Deccan Plateau by Krishnamachari (1974)) showed a high prevalence rate of 50%. Sathe and Dandre's (1975) study in Aurangabad region of Maharashtra revealed the same story. In subsequent years, a study amongst school children in the same area indicated a prevalence of 30%. A study amongst school children in Bombay by Shah showed a similar prevalence. In the Narmada valley in Gujarat, a prevalence of 36.7% was observed by Edibam et al (1972). A recent study among school children in Delhi by Pandav et al (1982) showed the prevalence rate between 15 to 30% in different schools. A study in the tribal areas of Visakhapatnam by Swarajya Lakshmi (1985) revealed the prevalence of endemic goitre varying between 18-56%. Shah after studying 6000 subjects in Baroda district, found high prevalence of different grades of goitre.

1.03 The present prevalence study

The ad-hoc surveys mentioned above and the clinical impressions in different parts of India strongly indicated that iodine deficiency disorders are not only restricted to the mountainous and hilly areas of the Sub-Himalayan range but are also in many other regions with different geographical characteristics. The "Extra-Himalayan Foci" where these studies

were conducted had no similarities regarding geographical and meteorological characteristics, food and living habits of the affected population. The endemic areas were located in plains, mountains, riverine areas and plateaux, and the affected population were both tribals and non-tribals with significantly differing dietary habits.

It was strongly felt that before the universal iodation of salt programme goes into full operation, more reliable information regarding the prevalence of iodine deficiency disorders in the different regions of India with different geographical characteristics should be made available to the planners and decision makers. It would have been improper to treat the Sub-Himalayan region as the only affected region in the country with higher priority for receiving iodated salt and treating the rest of the country as non-endemic with lower priority. It was therefore decided by the ICMR, in consultation with the Ministry of Health & Family Welfare, to conduct a study in different parts of India to assess the prevalence of iodine deficiency disorders in different age groups of the population and to identify other underlying etiological factors like staple food and drinking water. The project started in 1983 and concluded by the end of 1986.

2. Materials and Methods

2.01 The Study Design

The study design was developed in such a way that the objectives could be reached in the shortest possible time. The sample selection was based on the recommendations of Perez et al (1960) which suggested that the different areas to be studied in a national or regional survey should be homogeneous in respect of geographical characteristics, agricultural pattern, economic status and even dietary practices. The number of persons to be studied within an area would vary according to the degree of homogencity of the area and the prevalence of goitre. It was suggested that approximately 1% of the population would provide valid estimate in large homogeneous population. However, the sample size required for different levels of goitre prevalence and the degree of accuracy required, as suggested by Perez et al, is shown in the following table:

Relationship of maximum likely error to the number of persons examined and the goitre rate encountered

Percentage with goitre	Maximum likely error				
	10%	20%	25%	30%	40%
5	7600	1900	1216	855	485
10	3600	900	576	405	225
20	1600	400	256	180	100
30	932	233	150	105	58
40	600	150	96	68	38
50	400	100	64	45	25

2.02 Selection of the study area

On the basis of above recommendations and from the evidence of endemicity in different parts of the country revealed by earlier ad-hoc studies, fourteen districts in nine states were selected for the study. The names of the co-ordinating centres and names of districts, the states to which they belong and the centres which participated in this study and were responsible for the different states are shown in the table below:

Overall Coordinator—Indian Council of Medical Research, New Delhi

Co-ordinating Centres	States Co-ordinated
All India Institute of Medical Sciences, New Delhi	Assam, Bihar, Uttar Pradesh, Manipur, Madhya Pradesh
National Institute of Nutrition, Hyderabad	Andhra Pradesh, Gujarat, Tamil Nadu, Maharashtra.

Participating Centres

Districts	States	Participating Centres
Visakhapatnam	Andhra Pradesh	Andhra Medical College, Visakhapatnam
Dibrugarh	Assam	Assam Medical College, Dibrugarh
Muzaffarpur	Bihar	Patna Medical College, Patna
Sitamari		
Surat	Gujarat	Government Medical College, Surat
Mandla	Madhya Pradesh	S.S. Medical College, Rewa
Dhule	Maharashtra	Government Medical College, Aurangabad
Central Manipur	Manipur	Regional Medical College, Imphal.
West Manipur		
Nilgiri	Tamil Nadu	St. John's Medical College, Bangalore. UPASI, Nilgiris
Baharaich	Uttar Pradesh	K.G. Medical College, Lucknow
Basti		
Gorakhpur		
Mirzapur		

In the selected districts, it was planned to survey a total of 40-50 thousand population to ensure that the maximum likely error would be less than 5%. All the primary health centres (PHC) under each selected district were enumerated in alphabetical order and 50% of them were selected by the procedure of random selection. The total 40-50 thousand population to be surveyed per district was proportionally allocated to these selected PHCs according to their population sizes. Following this, all the villages under each selected PHC were listed in alphabetical order and sufficient number of villages were selected by random sampling with reserve villages to cover the allocated population for that PHC. Each of these villages formed the geographical unit of the survey and the entire population of each of these villages was surveyed serially until the target population was met.

Each participating centre, responsible for the survey in each state, was headed by a principal investigator and a number of field and administrative staff. Two coordinators, one located in the All India Institute of Medical Sciences, New Delhi, and the other in the National Institute of Nutrition, Hyderabad, coordinated and supervised the surveys in the states allocated to each centre.

2.03 Survey instruments

Two types of proformae for eliciting information at village level and at household level were developed centrally and pre-tested by the principal investigators and the necessary modifications incorporated for the finalised version.

The following two proformae were used in the survey:

(*i*) *Village Proforma*

Village proforma was designed for eliciting information about the village on the following:

(*a*) Type of village (whether tribal or otherwise etc.)

(*b*) Sources of drinking water.

(*c*) Type of salt generally consumed by the villagers

(*d*) Staple food of the inhabitants of the village

(*e*) Total number of households and the population in the villages.

(*ii*) *Household Proforma*

This proforma was designed to elicit information relating to all members of the household, and to record the findings of clinical examination of each member of the household for goitre and cretinism.

2.04 Survey techniques

The information was collected by three different techniques:

(*i*) *By interviews*

Interviews were held with the Sarpanch or the village leader to elicit information pertaining to the village and with the head of the household regarding the general information about the household.

(*ii*) *By clinical examination*

The entire population in the survey area was subjected to individual clincial examination for detection of thyroid enlargement and for neurological and classical cretins. For the purpose of the study, Stanbury's classification for grading of goitre was adopted.

Stanbury's classification

Grade Oa : Thyroid not palpable or if palpable, not larger than normal.

Grade Ob : Thyroid distinctly palpable but usually not visible with head in either a normal or a raised position, considered to be definitely larger than normal, at least as large as the distal phalanx of the subject's thumb.

Grade I : Thyroid easily palpable and visible with the head either in normal or a raised position. The presence of a discrete nodule qualifies a patient for inclusion in the grade.

Grade II : Thyroid easily visible with the head in a normal position.

Grade III : Goitre visible at a distance.

Grade IV : Monstrous goitres.

2.05 Techniques of thyroid examination for goitre

The subject to be examined was requested to start walking towards the examiner from a line marked at a distance of approximately two metres. This enabled the examiner to have a look at his gait, body proportion and the enlarged gland if any i.e. grade III and IV goitre. Then the subject stopped walking and faced the examiner at a close distance with the front of the subject's neck well exposed to light. The presence of visible goitre was detected straightway with the neck in normal position (grade II goitre). The subject was then requested to extend his neck and asked to swallow which helps to note the visible enlargement of the thyroid (grade I goitre). The thyroid gland was then palpated by the examiner with the subject turning his back to the examiner either in standing or sitting position. The palpation confirmed and supplemented the results of the inspection. The consistency and the nodularity of the gland were assessed by the forefingers of the examiner with the hands along the trachea.

Very young children were examined in supine position. The examiner raised the child slightly by placing his left hand under the shoulder blades with the child's head resting on the examining table. The examiner then palpated the thyroid areas with the forefinger of his right hand.

A very detailed manual of the study was prepared at All India Institute of Medical Sciences which is placed at Appendix I.

2.06 Biochemical analysis

The iodine content of drinking water and excretion of iodine in urine were the two biochemical parameters selected for this survey. For the assessment of iodine in drinking water, 100 ml. of water from all the principal sources of drinking water was collected from each survey area. Similarly, urine samples were collected from every fiftieth individual examined in the villages. The samples were carefully sealed and sent quickly to the two Iodine Monitoring Laboratories at the All India Institute of Medical Sciences, New Delhi and the National Institute of Nutrition, Hyderabad. Iodine in urine was estimated and expressed as micrograms per gram of creatinine and also per 100 ml of urine. Iodine content of water was expressed as micrograms per litre of water.

2.07 Operational details of the survey

All staff members recruited in the participating centres were given inservice training for the survey operation at the two coordinating centres. Essentially, the method of survey consisted of the project staff introducing themselves to each of the selected villages with the help of the local health service functionaries and administering the household schedule through door-to-door visit. An attempt was made to cover the entire population of the village, but if some persons could not be contacted, at least three attempts were made to contact them. Those who could not be contacted inspite of these attempts were dropped from the study and were considered as non-responders.

The next step was the recording of the details in the village proforma by administering it to the Sarpanch or the village leader. After completion of the household and village proformae, water and urine samples were collected for onward transmission to the Iodine Monitoring Laboratories after proper labelling with identification details.

2.08 Time-frame and analysis plan

The study covered a period of almost 2 years (1984-86). Following are the broad parameters on the basis of which the analysis was planned:

(*a*) Demographic characteristics of the population of the study area.

(*b*) Age, sex and grade specific goitre and cretinism prevalence rates.

(*c*) Prevalence of goitre and cretinism by type of population viz., tribal, non-tribal and tea estate worker.

(*d*) Prevalence of goitre by type of salt consumed and by the principal sources of water supply for drinking.

(*e*) Prevalence of goitre by staple diet.

(*f*) Urinary iodine content of the population with different prevalence rates of goitre.

(*g*) Iodine content of drinking water in villages with prevalence of goitre.

3. Results

3.01 Population Surveyed

Population in the selected 14 districts was 4,58,192 consisting of 1.7 per cent of the population of these districts. The sample size was within the range of 0.9 per cent to 2.3 per cent in all the districts except in Muzzafarpur and West Manipur districts. In Muzaffarpur district, the sample size was 0.3 per cent and it was 12.6 per cent in West Manipur district (Table 3.01).

3.02 Demographic Profile of sample population

Sex-ratio: (number of females per 1000 males)

In the study area the male population in all the districts, except in Surat and Nilgiri districts, was higher than the female population. In these two districts, the sex-ratio was 1012 and 1041 respectively. In the other twelve districts it varied between 834 in Mirzapur and Mandla districts and 999 in Central Manipur district.

In Surat, Nilgiri, Basti, Gorakhpur and Mirzapur districts, the differences between the sample sex-ratio and the corresponding district's sex-ratio were significant at $P<0.05$. However, overall sex-ratio in the sample population (904) was not significantly different from that of the country's population. (933-1981 Census) (Table 3.02).

3.03 Age structure

Population distribution in the selected districts showed a declining trend with increasing age-group with the exception of (0–4) years and (5–9) years age-groups. It was higher in (5–9) years age-group than in (0–4) years age-group except in Dibrugarh district.

In the age-group 44 years and above, the population in the districts varied between 10.0 per cent and 4.9 per cent. It was, however, only 1.5 per cent in Dibrugarh and Nilgiri district. Mis-reporting of age, specially in rural population is a known phenomenon. The age-specific goitre profile thus, may be interpreted with this limitation (Table 3.03).

3.04 Type of population

The study covered non-tribal, tribal and tea estate population. The non-tribal population was 70.8 per cent and constituted the largest proportion in 10 districts. There was no non-tribal population in Nilgiri and West Manipur districts. In Mandla district too, a very small proportion of population was non-tribal. In Surat, Visakhapatnam, Dibrugarh, Mandla, Dhule and Central Manipur districts the surveyed population comprised of both tribals and non-tribals. In Central Manipur and Mirzapur districts, however, the proportion of tribal population was very small. In Nilgiri district the sample consisted of

only tea estate population. In Dibrugarh, also, tea estate population in the sample was as high as 34.3 per cent. (Table 3.04). Tea estate population are migrants from various states belonging to different ethnic groups and they form a heterogeneous community by themselves. Further all tea plantation areas are of similar geographical characteristics viz soil composition, topography, climatic conditions etc, which offer unique and specific living conditions to the population. Tea-estate propulation were, therefore, taken as a separate group in the study.

3.05 Occupational pattern

Agriculture is the predominant sector of rural economy in India. About 60.5 per cent total working force earn their livelihood from agriculture. Among the surveyed population too, about 69 per cent were engaged in agriculture and the rest were either in business and service, or were artisans and landless labourers. (Table 3.05).

3.06 Non-response

In the total estimated population of 458, 192 persons in the selected study area, 429 persons could not be located. 47, 839 persons (10.4%) could not be examined as they were absent during the visit of the project staff and also in their subsequent three re-visits as they were working in the farms or elsewhere. Dibrugarh district alone accounted for 4.4 per cent of such population. In the remaining 13 districts the absentee population was very small ranging between 0.2 per cent in Visakhapatnam district to 1.6 per cent in Dhule district. The male and female proportions of absentee population were 60.6% and 39.4% respectively. 'Non-response' was higher in male population in all the districts except in Baharaich district (Table 3.06).

3.07 Study area

Based on geographical features, the selected fourteen districts can be divided into four distinct regions.

Sub-Himalayan region:

Baharaich, Basti and Gorakhpur districts of Uttar Pradesh, Sitamari district of Bihar and Dibrugarh district of Assam are situated in the foothills of Himalayas. All these are flood-prone districts with consequent serious leaching problem. Rainfall is copious in these districts.

Mountainous region:

Mandla in Madhya Pradesh, Nilgiri in Tamil Nadu and West Manipur are the hilly districts. The altitudes of the hills range between 500–1000 metres in Mandla district and 1000–2000 metres in Nilgiri and West Manipur districts.

Coastal region:

Visakhapatnam in Andhra Pradesh and Surat in Gujarat are two coastal districts in

the eastern and western coasts of India respectively. The Eastern Ghat and the Western Ghat hill ranges pass through these two districts offering both the districts coastal as well as hilly geo-climatic conditions.

Plains region:

Dhule in Maharashtra, Mirzapur in Uttar Pradesh, Muzaffarpur in Bihar and Central Manipur in Manipur are the four plains districts surveyed in the study. Dhule and Central Manipur districts are also having partially hilly characteristics.

3.08 Goitre and nodular goitre:

In the fourteen districts, 4,09,923 persons were clinically examined, of which 86,628 persons were found to be goitre affected including 14,953 persons having nodular goitre. The overall prevalence rate of goitre in the population was 21.1 per cent and that of nodular goitre was 17.3 per cent among the goitre affected population.

In the districts of Sub-Himalayan region, the prevalence rates of goitre varied from 18.6 per cent in Gorakhpur district to 65.8 per cent in Dibrugarh district. In the mountanous region, the lowest rate of prevalence was 6.9 per cent in Nilgiri district and the highest was 34.4 per cent in Mandla district. In the two coastal districts of Visakhapatnam and Surat the rates were 15.8 per cent and 22.4 per cent respectively. In the plains, the prevalence rate was observed at a lower range between 6.2 per cent in Mirzapur district and 33.7 per cent in Muzaffarpur district. Thus, the most intensive goitre-affeced area was Dibrugarh district of Assam (65.8%) and the least was Mizrapur district of Uttar Pradesh (6.2%).

The district-wise prevalence rates are shown in Table 3.07.

The proportion of nodular goitre to total goitre cases was highest in Dibrugarh district being 69.6 per cent which contrbuted to high prevalence of 17.2% in the pooled sample In Muzzafarpur, Sitamari, Gorakhpur, Mirzapur and Baharaich districts, the proportions were 11.1%, 9.7%, 9.9%, 8.9% and 7.5% respectively. In the remaining districts, the proportion varied between 1.4 per cent in Dhule district and 4.0 per cent in Basti district. Nodular goitre among infants was observed in Andhra Pradesh, Sitamari, Surat, Mandla. Baharaich and Basti districts. 22.2% of goitre affected infants had nodular goitre in Baharaich, 11.1% in Sitamari, 5.5% in Basti and 3.8% in Visakhapatnam, 38.1% in Surat and 20.0% Mandla. In (1–4) years and (5–9) years age groups, the proportion of nodular goitre was highest in Dibrugarh district. In all other districts, except Sitamari, nodular goitre was highest in 40 years and above age group. In the pooled population of all districts, highest proportion of nodular goitre was observed in age group 40 years and above and lowest in 20-24 years age group (Table No. 3.08).

3.09 Sex-specific prevalence of goitre:

The prevalence of goitre in male population was 15.5 per cent and that in female

population was 26.8 per cent. The difference in rates was statistically significant ($p<0.01$). In all the fourteen districts also the difference in male-female prevalence rate was statistically significant ($p<0.05$). However, in Visakhapatnam, Central Manipur and Nilgiri districts, for each male case there were 3 female cases of goitre. In Surat, Gorakhpur and Mirzapur the ratio was within the range of 2-2.3 and in the remaining districts, it varied between 2.1 and 1.5 (Table 3.09).

3.10 Goitre grade

As already mentioned in the methodology, goitrous population was classified in five groups by grade, based on Stanbury's classification. Overall, 7.6 per cent of grade Ob, 8.6 per cent of grade I, 3.4 per cent of grade II, 1.2 per cent of grade III and 0.3 per cent of grade IV goitres were identified. Both grade Ob and I were highest in 15–19 years age group, grade II was found highest in 20–29 years age group and grade III and IV in 40+ years age-group. (Table 3.11)

Proportion of grade Ob of all goitres was highest (74.5%) in Surat district and lowest (23.5%) in Dibrugarh district, whereas, grade I was highest (65.7%) in Dibrugarh district and lowest (20.8%) in Surat district. Grades Ob and I combined, was highest in Dhule district and lowest in Basti district being 96.9 per cent and 58.0 per cent in the goitrous population of the respective districts. In the remaining districts, there was wide range of variation between the two extremes.

Grade II goitre was high in proportion in all the surveyed districts of Uttar Pradesh and Bihar, Nilgiri district of Tamil Nadu, Visakhapatnam district of Andhra Pradesh and West Manipur district of Manipur State, ranging between 13.3 per cent and 28.0 per cent. In the remaining districts grade II goitre varied between 2.4 and 4.7 per cent.

The proportion of grade III and IV goitres combined in goitrous population ranged between 0.6 per cent in Dhule district where there was no case of grade IV goitre and 15.0 per cent in Basti district (Table 3.10).

3.11 Age-specific prevalence of endemic goitre

From the age-group (1–4) yrs till the age-group (10–14) yrs the increase in the rates of prevalence was significantly high. In the age group (10–14), yrs the rates were highest both in male and female population. Thereafter, both in male and female populations, a decline in the rates was observed till the age group of 40+yrs. In the case of females, the decline in the rate was gradual with increasing age-group. On the contrary, in males the rates were almost constant but for a marginal decline from (25–29) years age-group.

Overall, in each age-group, prevalence in female population was higher than that of male population being 26.8 per cent as against 15.5 per cent. The difference in rates was statistically significant ($p<0.01$).

Prevalence of grades Ob, I and II goitres was unevenly distributed in the age-groups between (1–4) and 40+ years. But in case of grades III and IV goitres, the prevalence

showed an increasing trend with higher age-group except in Visakhapatnam where the distribution of these two grades of goitre was uneven (Table 3.11).

Endemic goitre:

Non-toxic sporadic goitre is present all over the world. From the clinical, physiopathological and anatomical points of view, endemic and sporadic goitre are similar. The definition of endemicity is thus based only on statistical criteria, i.e. a threshold of goitre frequency above which the disease is regarded as endemic in a well defined geographical area. According to Stanbury's epidemiological criteria, endemic goitre would be considered to exist when (a) more than 5 per cent of an adolescent or pre-adolescent group have 'Grade I' goitre or, (b) more than 30 per cent are assigned to 'Grade Ob' or above.

The endemicity would be re-affirmed if it could be shown in a fair sample of the population that the mean daily excretion of iodine in urine is(a) less than 50 μg per 24 hours or, (b) less than 50 μg per gram of creatinine, in randomly obtained specimens. This feature is discussed later.

Based on criterion of 'more than 5 per cent of an adolescent group having 'Grade I' goitre', it was found that endemic goitre existed in 12 districts out of 14 selected districts. Only in Nilgiri and Mirzapur districts, the prevalence rate of grade I goitre was below 5 per cent in adolescent as well as pre-adolescent age group. (Table 3.11).

In an epidemiological study it is possible that grade Ob goitre is under-reported due to non-identification. Therefore, the criterion(b) is not exercised for classifying endemicity of goitre.

3.12 Cretinism

A total of 3,011 cretins, (1,130 males and 1,881 females) were identified in the population examined. This recorded an overall prevalence rate of 0.7 per cent, 0.5 per cent in male population and 0.9 per cent in female population.

In the study districts, prevalence of cretinism was highest in West Manipur (6.1%) followed by Central Manipur (3.0%). In Muzaffarpur, Dibrugarh, Mandla and Nilgiri districts, prevalence rates varied between 1.7 per cent and 2.2 per cent. In other districts, prevalence rates were less than 1 per cent, varying between 0.1 and 0.4 per cent.

Cretinism was found to be higher in the female population, being 0.9 per cent as against 0.5 per cent in the males which was not statistically significant ($p<0.05$). In West Manipur again, the prevalence rate in the females was highest being 9.5 per cent followed by Central Manipur (5.0%). This difference is significant ($p<0.05$). However, the rates were same in male and female populations in Visakhapatnam, Mandla, Dhule, Basti and Gorakhpur districts. In Sitamari and Mirzapur districts, the prevalence rates in male population were slightly higher than those of females. (Table 3.12).

It has already been mentioned that cretins were traced in the population by identifying 1) feeble-mindedness; 2) deaf-mutes; 3) gait defects; 4) squint; 5) hypothyroidism. All these abnormalities were detected in all the districts, and more than 70 per cent of cretins indicated more than one abnormality. 57.8% of the cretins were without goitre.

Details of all types of abnormalities in each district are stated below.

Visakhapatnam: Out of 74 cretins in 32,720 population, most prevalent abnormality was deaf-mutism (37.8%) followed by stunted growth (25.7%) and gait-defects (21.6%). Other abnormalities varied between 2.7 per cent and 10.8 per cent.

Dibrugarh: In this district, 510 cretins were traced in 23,472 persons. Hypothyroidism was predominantly manifested in the cretins, being 88.6 per cent. Stunted growth and squint were found in 42.9 per cent and 36.1 per cent cretins respectively. Other abnormalities varied between 7.3 per cent and 10.4 per cent.

Muzaffarpur and Sitamari: The abnormality pattern in these two districts of Bihar was similar. There were 88 and 233 cretins among 5216 and 20,985 persons respectively. In both the districts, feeble mindedness and hypothyroidism were highest and almost equally prevalent among the cretins. Feeble mindedness was present in 43.2 per cent and 58.4 per cent, and hypothyroidism in 40.9 per cent and 57.1 per cent of cretins respectively. Other abnormalities were found in less than 10.3 per cent of cretins.

Surat: Among 25,254 persons, 113 cretins were detected. Abnormality of gait-defects was highest, being 38 per cent. Other abnormalities ranged between 20.4 per cent and 23.0 per cent in cretins except hypothyroidism which was only in 5.3 per cent.

Mandla: In this district, 274 cretins were found in a population of 12,975. Feeble mindedness was the most common finding (83.9%). Other abnormalities ranged between 5.5 and 12.8 per cent.

Dhule: This district had only 26 cretins in a population of 32,507. Feeble-mindedness was the highest prevalent abnormality (50.0%). Other abnormalities were found between 11.5 and 19.2 per cent.

Central Manipur: Among 18,804 population, 563 cretins were traced. Deaf-mutism and feeble mindedness were detected among 68.7 and 64.4 per cent respectively. Other abnormalities were found in less than 8.0 per cent of cretins.

West Manipur: In this district 481 cretins were found in 7,828 population. Deaf-mutism feeble mindedness and gait-defects were found in 34.3, 30.4 and 19.7 per cent of cretins respectively. Other abnormalities varied between 1.7 and 9.4 per cent.

Nilgiri: There were 97 cretins in a population of 5,678. Hypothyroidism was found in 84.5 per cent of cretins. Other abnormalities ranged between 2.1 and 6.2 per cent.

Baharaich: In this district, 121 cretins were identified among 49,723 persons. Deaf-mutism and hypothyroidism were the highest manifested abnormalities, found in 46.3

and 42.3 per cent of cretins respectively. Other abnormalities varied between 5.0 and 19.8 per cent.

Basti: There were 273 cretins in a population of 68, 620 . Feeble mindedness, deaf-mutism and gait-defects were the three major abnormalities found in 66.7%, 63.0% and 42.8% of cretins respectively. Other abnormalities varied between 12.1 and 12.8 per cent.

Gorakhpur: In a population of 62,003, 34 cretins were detected. The different abnormalities varied between 14.7 and 35 .3 per cent, highest being deaf-mutism.

Mirzapur: There were 124 cretins in a population of 44,138, out of which 122 cretins (98.4%) were feeble minded. Deaf-mutism was found in 117 (94.4%) and gait defects in 27(21.8%) cretins. Other abnormalities varied between 4.0 and 14.5 per cent.

Districtwise details are presented in Table 3.13

In the total cretin population, 44.9 per cent had feeble mindedness, 34.5 per cent were deaf-mute, 31.0 per cent were hypothyroid, 14.9 per cent had gait-defects, 14.1 per cent had stunted growth and 12.3 per cent had squint (Table 3.13). Two or more manifestations were present in a large percentage of cretins.

3.13 Endemic cretinism:

It has been long recognised that endemic goitre and endemic cretinism are geographically co-incident, though not all goitre endemic areas have endemic cretinism. Endemic cretinism is thus associated with endemic goitre. Severe iodine deficiency is the cause of endemic cretinism (PAHO 1974).

Any individual belonging to an endemic goitrous community with one or more abnormalities which are defined to identify a cretin (described in Chapter 2) is considered as 'Endemic cretin'.

Based on the above definition, it was observed that endemic cretinism existed in all the districts under study.

3.14 Findings from village level data

3.14.1 *Prevalence of goitre in various types of population*

The types of population and their proportion in the total population had already been mentioned in the begining of this Chapter.

The prevalence of goitre was 19.4 per cent in non-tribal villages, 25.2 per cent in tribal villages and 23.6 per cent in tea-estates. The differences in prevalence rates among tribal and non-tribal and non-tribal and tea estate workers were significantly high ($p < 0.05$).

In the districts with both tribal and non-tribal populations, prevalence of goitre among tribals was higher than that in non-tribals except in Mandla and Central Manipur. However, in Mandla, non-tribal population and in Central Manipur, tribal population were very small to provide adequate sample size for valid estimation.

Among the tea-estate population of Dibrugarh district, the prevalence rate was recorded at 45.2 per cent and in Nilgiri district, where it was entirely tea-estate population, the prevalence rate was 6.9 per cent (Table 3.14).

3.14.2 *Prevalence of goitre with various staple diets*

Wheat or rice or both were the major staple diet of the study population. However, millet and maize also formed staple diet in Visakhapatnam, Surat, Mandla, Dhule and Mirzapur districts.

Prevalence of goitre was higher among rice-eating population. Even in the four districts where rice and wheat eating populations existed, in three such districts the prevalence rates among the rice eating populations were higher. In Dibrugarh, Muzaffarpur and Sitamari, where both rice and wheat were staples, the prevalence rates were high being 69.7, 33.7 and 31.8 per cent respectively. Prevalence rates in the rice and millet eating population also were lower than those of rice eating population in Surat and Mandla districts. However, in this district millet eating population was not adequate in number for appropriate sample size (Table 3.15).

3.14.3 *Prevalence of goitre in villages using various sources of water*

The sources of drinking water in villages were well, hand-pump, river and pond. In four districts other sources of water were also used, such as hill stream, rivulet etc.

There was no definite indication of variation in goitre prevalence with different sources of drinking water. However, it was observed that in villages where the population used both hand-pump and well water, the prevalence rates were higher than those using only hand-pump or well. In only one district, viz. Dhule, all sources of drinking water were in use, and the prevalence rate in this district was highest among the population using pond—40.0% and both river and pond—49.6% as compared to the rates prevailing among users of other sources of water viz hand-pump—19.4%, well—14.5% and both hand-pump and well—14.9% and river 12.4% (Table 3.16).

3.15 Laboratory parameters and goitre prevalence

It was envisaged that 2% of urine samples of the study population and water samples from all the sources in villages in the districts would be sent to their respective Iodine Monitoring Laboratories set up at two coordinating centres, viz. All India Institute of Medical Sciences, New Delhi and National Institute of Nutrition, Hyderabad, but in the field situation transportation of all samples could not be effectively maintained throughout the study period. Secondly, urine samples from selected individuals were collected on the spot in bottles by adding toluene as preservative. But due to long time lapse before laboratory test and transportation hazard the creatinine content of urine was reduced to a great extent and the iodine creatinine ratio was erroneous. Therefore, the results of urine analysis have not been included in the report.

Iodine content in drinking water sources of 5 districts viz. Visakhapatnam, Sitamari, Surat, Dhule and Nilgiri districts were measured and there was clear evidence of high correlation of goitre prevalence with low iodine content in water. In Visakhapatnam 179 water samples from various drinking water sources were analysed for iodine content, In 157 samples, the iodine content was more than 5μg/litre and in those areas prevalence was 9.7 per cent. In 22 samples iodine content were less than 5μg/litre and in those areas the prevalence was 25.1 per cent. Similarly, in Sitamari, Surat, Dhule and Nilgiri, the prevalence in villages with low iodine content (<5μg/litre) in drinking water sources were 36.2% (n=6), 24.2% (n=16), 28.1% (n=29), and 10.2% (n=5) respectively and with high iodine content (>5μg/litre) the prevalence rates were 33.5% (n=13), 15.0% (n=23), and 7.8% (n=12) in Sitamari, Surat & Dhule districts respectively (Table 4.01).

4. Discussion and Conclusions

The main objective of the study as mentioned earlier, was to identify the prevalence of endemic goitre and cretinism, the two major manifestations of iodine deficiency disorders, in regions of India where their presence was not suspected in the past. The Sub-Himalayan region, known as the conventional goitre belt of India, was the only region taken into consideration for the planning of the goitre control programme. Evidences of a few endemic foci outside the goitre belt were regarded more as "curiosities" and unexpected occurences. In view of the decision of the Government of India to adopt universal iodation of salt in stages, it became imperative to identify the endemic areas, especially those with high prevalence, in different regions of India for receiving iodated salt, on priority basis.

The 14 districts selected for the study have diverse geographic characteristics and hence different geo-chemical properties relating to iodine. Some of these districts were located in the Sub-Himalayan regions, some on hills, some in the coastal areas and others in the plains. In the extra Himalayan districts, the study covered three hilly districts, two coastal districts one each on the eastern and western coasts, and four districts located in the plains of India. Inspite of these diverse geographical, meteorological and presumably geochemical characteristics, the prevalence of endemic goitre in each of these districts is well above the level recognised for endemicity. In some, e.g. Dibrugarh, the level was alarming. In other words, 28 million people in these 14 districts are exposed to the risk of iodine deficiency disorders and of which at least 6 million people might be actual victims. Extension of such search in all districts in the country would have revealed staggering statistics. More alarming is the prevalence of endemic cretinism, though in varying proportion, in all the 14 districts, with West Manipur having the highest prevalence of 6.1%.

In the extra-Himalayan region, the study covered three hilly districts wherein the prevalence of endemic goitre in the pooled sample was found to be 24%. In the two coastal districts, the prevalence in the pooled sample was 19%, and in the four districts in the plains, it was 12%.

An interesting observation is the higher prevalence of endemic goitre among the tribal population and the tea estate workers as compared to the non-tribal population. The differences of prevalence rates amongst tribals on the one hand and the non-tribals and the tea estate workers on the other were significantly high ($p<0.05$). Due to resource and time constraints, the present study could not explore the detailed dietary practices of the surveyed population. Possibility of excessive consumption of goitrogenic foods by the tribals cannot be ruled out. Obviously, this could be an interesting area for future research. Another possible explanation is the dependence of the tribal population on the foods grown locally as compared to the non-tribals who normally obtain their food from the non-endemic regions as well.

The higher rates among the tea estate workers need further exploration. Among the tea estate population of Dibrugarh district, the prevalence rate was recorded at 42.2% and in the Nilgiri district where it was entirely tea estate population, the prevalence rate was only 6.9%. It should be noted that the Dibrugarh district lies in the Himalayan belt. In the districts with both tribal and non-tribal population, prevalence of goitre among tribals was consistently found to be higher than that of the non-tribals.

An attempt was made to explore whether the major staple in the daily diet could have any relationship with IDD prevalence. In all the regions of India, it was observed that the prevalence of goitre among rice eating population was always higher than those in the wheat eating population. The prevalence rate in the maize and millet eating population was lower that those of rice eating population. This area needs further research.

Due to limited number of water samples, it was not possible to link prevalence with sources of drinking water. However, it was observed that in villages where the population use both hand pump and well water, the prevalence was always higher than those using hand pump or piped water. The prevalence rate was higher among population using surface water e.g. river and pond as compared to the rate prevailing among users of sub-soil sources of water e.g. hand pump, tubewells.

The major finding of the study is the existence of huge areas in different parts of India having a high prevalence of iodine deficiency disorders. The conventional idea that it is restricted only to the Himalayan belt should be revised and more detailed search should be made in other regions in order to give priority in the salt iodation programme. It was not possible in the present study to identify other underlying causes of iodine deficiency disorders especially the possibility of consumption of a large amount of goitrogenic foods in the population to explain the higher prevalence. Similarly, due to shortage of time, it was not possible to link the consumption of various types of salt with the prevalence of these disorders.

However, the findings of the study should be interpreted with some caution as this was a multicentric epidemiological study which, by nature has some inherent limitations such as frequent transfer of staff, as well as subjectivity in assessement of goitre and cretinism. Due to these limitations, it is possible that some of the results may be at variance with what has been reported in other studies. It may be pointed out that all possible efforts were made to minimise such discrepancies.

TABLE 3.01

Total and sample population in the study districts

Sl. No.	District	Population		
		Total[1]	Sample	% sample to total
1.	Visakhapatnam	2,576,474	33,508	1.3
2.	Dibrugarh	1,904,305[2]	42,347	2.2
3.	Muzaffarpur	2,357,388	6,175	0.3
4.	Sitamari	1,932,147	23,130	1.2
5.	Surat	2,493,211	31,906	1.3
6.	Mandla	1,037,394	13,088	1.3
7.	Dhule	2,050,294	39,828	1.9
8.	Central Manipur	929,077	18,811	2.0
9.	West Manipur	62,289	7,871	12.6
10.	Nilgiri	630,169	5,682	0.9
11.	Baharaich	2,216,245	51,925	2.3
12.	Basti	3,578,069	71,413	2.0
13.	Gorakhpur	3,795,701	64,288	1.7
14.	Mirzapur	2,039,149	48,220	2.4
	TOTAL	27,601,912	458,192	1.7

1. 1981 Census data
2. 1971 Census data

TABLE 3.02

Sex-ratio of sample and total population in the study districts

Sl. No.	District	Population (Sample)		Sex-Ratio[3]	
		Male	Female	Sample	District[1]
1.	Visakhapatnam	16,840	16,651	989	981
2.	Dibrugarh	22,579	19,753	874	896[2]
3.	Muzaffarpur	3,111	3,047	979	963
4.	Sitamari	11,695	11,383	973	934
5.	Surat	15,834	16,028	1,012	924
6.	Mandla	7,127	5,948	834	1,003
7.	Dhule	20,432	19,333	946	946
8.	Central Manipur	9,408	9,403	999	991
9.	West Manipur	3,943	3,898	989	975
10.	Nilgiri	2,783	2,897	1,041	957
11.	Baharaich	27,483	24,408	888	855
12.	Basti	38,016	33,333	877	928
13.	Gorakhpur	34,896	29,350	841	940
14.	Mirzapur	26,269	21,915	834	928
	TOTAL	240,416	217,347	904	933

1. 1981 Census.
2. 1971 Census.
3. No. of females per 1000 males.

TABLE 3.03

Percentage distribution of sample population in different age-groups in study districts

Sl. No.	District	Sample population (%) in age groups									
		0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	44+
1.	Visakhapatnam	12.2	14.0	11.5	9.1	8.4	8.7	7.5	7.2	9.2	12.2
2.	Dibrugarh	15.1	14.6	12.7	9.8	8.8	8.8	6.4	6.4	6.4	1.5
3.	Muzaffarpur	15.9	22.2	15.1	5.9	6.1	8.4	9.9	6.0	5.6	4.9
4.	Sitamari	16.6	20.8	14.4	7.2	6.7	7.2	7.7	5.2	6.0	8.2
5.	Surat	12.4	12.6	12.4	9.8	10.5	8.5	6.5	5.8	6.7	14.8
6.	Mandla	9.6	16.3	13.8	11.0	9.1	6.7	6.7	4.8	10.4	11.6
7.	Dhule	14.6	14.0	13.3	8.3	8.4	7.3	7.1	5.8	7.6	13.5
8.	Central Manipur	11.1	14.1	12.6	11.2	8.9	9.3	6.3	6.7	5.4	14.4
9.	West Manipur	16.7	19.1	12.3	9.3	8.2	9.0	5.0	4.3	3.5	13.6
10.	Nilgiri	11.8	12.9	12.2	10.3	10.7	9.5	7.9	6.6	7.0	1.5
11.	Baharaich	12.5	14.6	13.4	8.1	7.8	7.9	7.3	6.4	9.0	13.6
12.	Basti	14.1	17.8	12.8	6.9	7.6	8.9	7.6	6.4	7.3	10.0
13.	Gorakhpur	15.3	16.5	12.3	7.6	7.7	7.7	7.8	6.0	7.0	12.6
14.	Mirzapur	18.5	18.0	13.4	7.8	9.4	9.0	7.1	5.7	7.1	4.0
	TOTAL	14.5	16.8	12.8	7.9	7.9	8.1	6.8	6.0	7.1	12.1
	All India (1981 Census)	14.1	13.4	12.1	10.1	8.5	7.4	6.5	5.7	5.0	17.2

TABLE 3.04

Percentages of tribal, non-tribal and tea-estate population in study districts

Sl. No.	District	Population (in per cent)			
		Non-tribal	Tribal	Mixed population (non-tribal and tribal)	Tea estate workers
1.	Visakhapatnam	66.3	33.7	—	—
2.	Dibrugarh	—	17.1	48.6	34.3
3.	Muzaffarpur	100.0	—	—	—
4.	Sitamari	100.0	—	—	—
5.	Surat	33.8	66.2	—	—
6.	Mandla	3.4	96.6	—	—
7.	Dhule	54.1	45.9	—	—
8.	Central Manipur	58.5	2.5	39.0	—
9.	West Manipur	—	100.0	—	—
10.	Nilgiri	—	—	—	100.0
11.	Baharaich	100.0	—	—	—
12.	Basti	100.0	—	—	—
13.	Gorakhpur	100.0	—	—	—
14.	Mirzapur	80.2	3.2	16.6	—
	TOTAL	70.8	18.2	6.6	4.4

TABLE 3.05

Percentage of sample population by occupation in study districts

Sl. No.	District	Agricultural labourer	Landless labourer	Artisan	Business	Service	Others including tea-estate workers
1.	Visakhapatnam	72.9	17.9	3.0	1.4	1.5	0.3
2.	Dibrugarh	32.5	48.1	3.1	8.3	6.7	1.3
3.	Muzaffarpur	38.1	23.4	0.1	4.0	7.5	26.9
4.	Sitamari	53.0	27.6	0.1	2.8	4.4	12.1
5.	Surat	50.2	35.2	2.1	1.9	7.4	3.2
6.	Mandla	95.1	2.7	0.2	0.2	0.3	—
7.	Dhule	63.8	30.7	0.9	1.6	2.0	1.0
8.	Central Manipur	69.7	1.1	6.9	6.2	15.6	0.5
9.	West Manipur	83.9	—	0.2	0.7	14.5	0.7
10.	Nilgiri	0.7	—	0.03	0.2	—	99.0
11.	Baharaich	77.1	13.7	0.5	6.0	2.1	0.6
12.	Basti	86.6	9.3	1.5	1.1	1.1	0.4
13.	Gorakhpur	72.2	20.0	0.9	3.8	2.7	0.4
14.	Mirzapur	78.4	14.4	4.4	1.3	1.2	0.4
	TOTAL	69.4	21.3	2.1	2.8	2.1	2.3

TABLE 3.06

Population examined and type of non-response in study districts

Sl. No.	District	Population	Untraceable	Absent at the time of survey	Non-identification of goitre grade
1.	Visakhapatnam	32,720	17	771	3
2.	Dibrugarh	23,472	15	18.860	—
3.	Muzaffarpur	5,216	17	942	1
4.	Sitamari	20,985	52	2,093	3
5.	Surat	25,254	44	6,608	10
6.	Mandla	12,975	13	100	30
7.	Dhule	32,507	63	7,258	—
8.	Central Manipur	18,804	—	7	1
9.	West Manipur	7,828	30	13	1
10.	Nilgiri	5,678	2	1	—
11.	Baharaich	49,723	34	2,168	—
12.	Basti	68,620	64	2,729	13
13.	Gorakhpur	62,003	42	2,243	17
14.	Mirzapur	44,138	36	4,046	3
	TOTAL	4,09,923	429	47,839	82

TABLE 3.07

Goitre cases and nodular goitre in study districts

Sl. No.	District	Population examined	Goitre cases		Nodular goitre	
			No.	Percent	No.	Percent
1.	Visakhapatnam	32,720	5,186	15.8	132	2.5
2.	Dibrugarh	23,472	15,441	65.8	10,754	69.6
3.	Muzaffarpur	5,216	1,758	33.7	196	11.1
4.	Sitamari	20,985	6,667	31.8	650	9.7
5.	Surat	25,254	5,722	22.7	136	2.4
6.	Mandla	12,975	4,465	34.4	132	3.0
7.	Dhule	32,507	5,375	16.5	77	1.4
8.	Central Manipur	18,804	1,964	10.4	37	1.9
9.	West Manipur	7,828	1,547	19.8	126	8.1
10.	Nilgiri	5,678	391	6.9	15	3.8
11.	Baharaich	49,723	10,045	20.2	757	7.5
12.	Basti	68,620	13,749	20.0	546	4.0
13.	Gorakhpur	62,003	11,564	18.6	1,149	9.9
14.	Mirzapur	44,138	2,754	6.2	246	8.9
	TOTAL	4,09,923	86,628	21.1	14,953	17.3

TABLE 3.08

Percentage of nodular goitre among goitre affected population according to age-groups in study districts

Sl. No.	District	Age-groups 0	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	44+	Total
1.	Visakhapatnam	3.8	4.3	1.8	0.6	3.7	1.8	2.0	3.4	3.3	3.4	4.8	2.5
2.	Dibrugarh	—	51.4	81.6	76.1	69.7	66.4	65.9	61.7	64.2	62.2	60.6	69.6
3.	Muzaffarpur	—	13.1	13.2	19.5	20.0	10.9	11.7	—	8.0	8.8	3.0	11.1
4.	Sitamari	11.1	4.8	8.3	12.7	13.8	9.9	10.3	9.9	11.3	7.7	7.0	9.7
5.	Surat	38.1	6.1	1.0	1.1	1.2	0.3	2.1	2.4	2.6	3.7	10.1	2.4
6.	Mandla	20.0	2.3	0.3	0.8	2.1	2.0	2.8	5.8	6.0	7.8	7.7	3.0
7.	Dhule	—	—	0.2	0.1	—	2.1	1.8	2.6	3.6	9.2	14.4	1.4
8.	Central Manipur	—	—	—	—	0.8	0.6	5.0	6.8	7.5	12.8	18.6	1.9
9.	West Manipur	—	2.1	—	0.8	0.3	0.8	1.7	0.8	—	4.6	44.7	3.7
10.	Nilgiri	—	—	—	7.7	1.5	3.9	—	0.7	—	11.1	14.7	3.8
11.	Baharaich	22.2	5.4	0.4	0.1	2.7	6.0	8.0	10.0	19.7	32.4	54.7	7.5
12.	Basti	5.5	2.9	0.8	0.4	1.5	2.9	3.9	5.6	5.4	13.3	27.1	4.0
13.	Gorakhpur	—	5.1	6.6	4.4	6.9	7.6	10.1	15.6	25.8	44.6	58.3	9.9
14.	Mirzapur	—	0.03	0.2	0.8	0.7	0.5	0.8	0.9	1.3	1.3	3.8	8.9
	TOTAL	18.6	23.8	20.4	13.3	13.5	12.9	15.8	15.1	19.5	20.9	26.9	17.3

TABLE 3.09

Prevalence of goitre in male and female population in study districts.

Sl. No.	District	Goitre (%)			
		All persons	Male	Female	Ratio (Female/Male)
1.	Visakhapatnam	15.8	7.0	24.6	3.5
2.	Dibrugarh	65.8	51.4	77.6	1.5
3.	Muzaffarpur	33.8	29.8	36.9	1.2
4.	Sitamari	31.8	27.6	35.4	1.3
5.	Surat	22.7	14.6	29.7	2.0
6.	Mandla	34.4	29.9	39.4	1.3
7.	Dhule	16.5	11.6	20.9	1.8
8.	Central Manipur	10.4	5.2	15.7	3.0
9.	West Manipur	19.8	14.8	23.7	1.6
10.	Nilgiri	6.9	2.9	10.5	3.6
11.	Baharaich	20.2	18.0	22.5	1.3
12.	Basti	20.0	16.0	24.3	1.5
13.	Gorakhpur	18.6	12.2	26.2	2.1
14.	Mirzapur	6.2	3.9	8.9	2.3
	TOTAL	21.1	15.5	26.8	1.7

TABLE 3.10

Percentage distribution of goitre cases by grade in goitre affected population in study districts

Sl. No.	Districts	Percentage of goitre cases by grade				
		Ob	I	II	III	IV
1.	Visakhapatnam	45.6	37.3	13.2	3.3	0.6
2.	Dibrugarh	23.5	65.7	9.6	0.9	0.3
3.	Muzaffarpur	39.4	34.7	19.3	4.5	2.1
4.	Sitamari	43.3	30.8	15.2	8.2	2.5
5.	Surat	74.5	20.8	3.9	0.4	0.4
6.	Mandla	50.1	37.3	7.6	4.7	0.3
7.	Dhule	34.5	62.4	2.5	0.6	—
8.	Central Manipur	66.3	28.8	2.9	1.0	1.0
9.	West Manipur	46.0	33.3	13.6	5.1	2.0
10.	Nilgiri	37.7	28.9	28.9	4.3	0.2
11.	Baharaich	26.2	42.6	21.7	6.9	2.6
12.	Basti	27.0	31.0	27.0	14.0	1.0
13.	Gorakhpur	29.6	33.3	26.3	8.1	2.7
14.	Mirzapur	35.4	30.6	23.3	8.1	1.6
	TOTAL	36.0	40.7	16.2	5.7	1.4

TABLE 3.11

Age-grade specific prevalence of goitre in study districts

District	Age Group (Yrs.)	Prevalence					
		Ob	I	II	III	IV	Total
Visakhapatnam	0	0.3	5.0	—	—	—	5.3
	1-4	3.1	0.8	0.1	—	—	4.0
	5-9	8.3	3.7	0.4	0.02	—	12.4
	10-14	7.7	6.5	2.0	0.03	0.03	16.3
	15-19	7.0	9.1	3.7	0.8	0.2	20.8
	20-29	9.4	7.7	3.3	1.0	0.2	21.6
	30-39	9.2	8.0	3.2	0.6	0.1	21.1
	40+	5.7	5.5	2.1	0.5	0.3	14.1
	All Groups	7.2	5.9	2.1	0.5	0.1	15.8
Dibrugarh	0	1.7	—	—	—	—	1.7
	1-4	25.4	27.6	0.5	0.03	0.1	53.6
	5-9	13.7	73.7	2.5	0.1	0.02	90.0
	10–14	13.7	65.3	7.2	0.2	0.03	86.4
	15–19	12.3	51.5	12.7	0.6	—	77.1
	20–29	16.3	43.5	9.2	1.1	0.1	70.2
	30–39	15.8	31.9	8.8	1.1	0.3	57.9
	40+	10.5	11.2	9.1	1.5	0.6	32.9
	All Groups	15.5	43.2	6.3	0.6	0.2	65.8
Muzaffarpur	0	6.1	—	—	—	—	6.1
	1–4	2.5	2.1	0.1	—	—	4.7
	5–9	6.1	2.9	1.8	—	—	10.8
	10–14	16.1	17.6	5.9	0.5	—	40.1
	15–19	23.5	35.0	15.5	—	—	74.0
	20–29	22.4	16.7	9.7	0.6	—	49.4
	30–39	20.1	15.8	7.5	2.8	0.8	47.0
	40+	13.4	17.5	17.7	7.5	5.0	61.1
	All Groups	13.3	11.7	6.6	1.5	0.7	33.7
Sitamari	0	1.4	—	—	—	—	1.4
	1–4	7.8	2.3	0.1	—	—	10.2
	5–9	11.9	5.6	0.7	—	—	18.2
	10–14	21.1	13.4	3.5	0.3	—	38.3
	15–19	20.8	16.1	6.3	1.3	—	44.5
	20–29	17.9	14.3	6.6	2.2	0.1	41.1
	30–39	13.6	12.4	6.9	5.0	0.8	38.7
	40+	12.1	13.0	13.4	10.5	4.8	53.8
	All Groups	13.8	9.8	4.8	2.6	0.8	31.8

Contd.

9652

TABLE 3.11 (Contd.)

District	Age Group (Yrs.)	Prevalence					
		Ob	I	II	III	IV	Total
Surat	0	3.4	—	—	—	—	3.4
	1–4	4.1	0.2	0.03	—	0.1	4.4
	5–9	20.0	3.6	0.7	—	—	24.3
	10–14	27.7	7.9	1.3	0.03	0.03	37.0
	15–19	25.4	8 .2	1.7	0.1	0.2	35.6
	20–29	23.9	8.7	1.6	0.2	0.1	34.5
	30–39	18.6	5.3	0.7	0.1	0.1	24.8
	40+	7.8	2.0	0.7	0.3	0.1	10.9
	All Groups	16.9	4.7	0.9	0.1	0.1	22.7
Mandla	0	10.0	2.5	—	—	—	12.5
	1–4	3.4	0.2	—	0.1	—	3.7
	5–9	25.9	2.2	0.1	0.05	0.05	28.3
	10–14	50.0	8.5	0.5	0.2	0.1	59.3
	15–19	24.6	26.3	2.3	0.3	—	53.5
	20–29	9.7	28.8	4.3	0.6	—	43.4
	30–39	6.0	16.7	7.4	0.9	—	31.0
	40+	4.3	10.4	8.6	1.8	0.5	25.6
	All Groups	17.3	12.8	3.6	0.6	0.1	34.4
Dhule	0	1.1	0.3	—	—	—	1.4
	1–4	5.0	1.9	0.2	0.02	—	6.9
	5–9	13.8	17.2	0.1	—	—	31.1
	10–14	10.1	18.9	0.2	—	0.2	29.4
	15–19	5.8	15.7	0.5	0.1	0.1	22.2
	20–29	4.0	16.2	0.9	0.1	0.02	21.2
	30–39	2.1	8.5	0.7	0.2	0.1	11.6
	40+	1.0	2.3	0.3	0.2	—	3.8
	All Groups	5.7	10.3	0.4	0.1	—	16.5
Central Manipur	0	1.2	—	—	—	—	1.2
	1–4	2.5	—	—	—	—	2.5
	5–9	2.6	0.3	—	—	—	12.9
	10–14	25.0	2.1	—	—	—	27.1
	15–19	9.4	12.1	0.8	—	—	22.3
	20–29	2.1	4.2	0.5	0.03	0.1	6.8
	30–39	1.3	2.0	0.4	0.1	0.1	4.0
	40+	0.6	1.5	0.5	0.4	0.3	3.3
	All Groups	6.9	3.0	0.3	0.1	0.1	10.4

Contd.

TABLE 3.11 (Contd.)

District	Age Group (Yrs.)	Prevalence					
		Ob	I	II	III	IV	Total
West Manipur	–0	—	—	—	—	—	—
	1–4	19.7	—	—	—	—	19.7
	5–9	24.5	7.5	1.7	—	—	33.7
	10–14	10.3	16.5	0.6	—	—	27.4
	15–19	1.0	18.0	4.5	—	—	23.5
	20–29	0.6	6.5	3.5	0.3	—	10.9
	30–39	1.0	1.6	5.2	0.3	—	8.1
	40+	1.0	0.6	4.1	4.5	2.1	12.3
	All Groups	9.1	6.6	2.7	1.0	0.4	19.8
Nilgiri	0	—	—	—	—	—	—
	1–4	0.8	0.1	0.1	—	—	1.0
	5–9	1.5	1.2	0.4	—	—	3.1
	10–14	4.7	4.3	2.0	—	—	11.0
	15–19	5.3	2.4	3.6	0.3	—	11.6
	20–29	2.8	2.6	3.1	0.3	—	8.8
	30–39	3.3	2.8	2.9	0.2	—	9.2
	40+	0.9	0.9	1.3	0.7	0.1	3.9
	All Groups	2.6	2.0	2.0	0.3	0.02	6.9
Baharaich	0	1.4	—	—	—	—	1.4
	1–4	1.3	0.3	0.04	002	0.04	1.7
	5–9	9.7	10.6	2.5	0.2	—	23.0
	10–14	8.6	28.7	8.8	1.5	0.01	47.6
	15–19	7.1	14.1	9.9	1.7	0.02	32.8
	20–29	6.2	7.0	6.7	1.4	0.4	21.7
	30–39	4.7	3.3	4.1	2.1	0.8	15.0
	40+	5.3	8.6	4.4	4.4	0.5	20.2
	All Groups	5.3	8.6	4.4	1.4	0.5	20.2
Basti	0	5.6	0.6	0.2	—	—	6.4
	1–4	3.8	1.8	0.5	0.06	0.01	6.2
	5–9	8.7	8.7	4.0	1.0	0.02	22.4
	10–14	10.0	14.3	11.4	4.1	0.02	38.8
	15–19	8.7	9.9	11.2	4.3	—	34.1
	20–29	1.6	6.3	0.3	0.04	—	8.2
	30–39	0.8	3.3	0.3	0.07	0.02	4.5
	40+	0.6	1.3	0.2	1.2	—	3.3
	All Groups	5.4	6.2	5.4	2.8	0.2	20.0

Contd.

TABLE 3.11 (Contd.)

District	Age Group (Yrs.)	Prevalence					
		Ob	I	II	III	IV	Total
Gorakhpur	0	2.6	0.7	0.1	—	—	3.4
	1–4	6.7	3.1	1.0	0.02	0.01	10.8
	5–9	15.9	11.7	6.1	0.2	—	33.9
	10–14	7.5	12.1	11.5	2.0	0.1	33.2
	15–19	4.5	9.2	9.3	2.8	0.2	26.0
	20–29	1.7	6.0	5.9	2.5	0.3	16.4
	30–39	0.7	2.3	2.5	2.7	0.6	8.8
	40+	0.4	1.0	1.2	1.7	1.7	6.0
	All Groups	5.5	6.2	4.9	1.5	0.7	18.6
Mirzapur	0	1.7	—	—	—	—	1.7
	1–4	1.9	0.5	—	0.04	—	2.5
	5–9	3.4	2.6	0.9	0.05	—	7.0
	10–14	6.2	4.1	2.4	0.2	—	12.9
	15–19	4.9	3.3	2.1	0.6	0.03	10.9
	20–29	3.0	2.3	1.2	0.4	0.1	7.0
	30–39	1.5	1.3	0.9	0.9	0.2	4.8
	40+	1.1	0.7	0.4	0.6	0.2	3.0
	All Groups	2.2	1.9	1.5	0.5	0.1	6.2
All districts	0	2.3	0.6	0.03	—	—	2.9
	1–4	5.8	3.3	0.3	0.03	0.02	9.5
	5–9	11.7	12.1	2.4	0.3	—	26.5
	10–14	13.0	16.8	6.3	1.2	0.02	37.3
	15–19	9.6	13.8	6.4	1.5	0.1	31.4
	20–29	7.1	9.6	4.8	1.3	0.2	23.0
	30–39	5.5	6.2	3.4	2.0	0.4	17.5
	40+	3.1	3.2	2.6	2.3	0.9	12.1
	All Groups	7.6	8.6	3.4	1.2	0.3	21.1

TABLE 3.12

Prevalence of cretinism in study districts

Sl. No.	District	Male		Female		All	
		No.	%	No.	%	No.	%
1.	Visakhapatnam	40	0.2	34	0.2	74	0.2
2.	Dibrugarh	199	1.8	311	2.4	510	2.2
3.	Muzaffarpur	25	1.1	63	2.4	88	1.7
4.	Sitamari	86	0.8	147	1.4	233	1.1
5.	Surat	50	0.4	63	0.5	113	0.4
6.	Mandla	149	2.1	125	2.1	274	2.1
7.	Dhule	14	0.1	12	0.1	26	0.1
8.	Central Manipur	90	1.0	473	5.0	563	3.0
9.	West Manipur	110	2.8	371	9.5	481	6.1
10.	Nilgiri	33	1.2	64	2.2	97	1.7
11.	Baharaich	60	0.2	61	0.3	121	0.2
12.	Basti	138	0.4	135	0.4	273	0.4
13.	Gorakhpur	23	0.1	11	0.1	34	0.1
14.	Mirzapur	113	0.5	11	0.1	124	0.3
	TOTAL	1130	0.5	1881	0.9	3011	0.7

TABLE 3.13

Prevalence of cretinism by manifestation in study districts

Abnormality		Visa-kha-patnam	Dibru-garh	Muza-ffar pur	Sita-mari-	Surat	Man-dla	Dhule	Cen-tral Mani-pur	West Mani-pur	Nil-giri	Baha-raich	Basti	Gorakh-pur	Mir-zapur	Total
Feeble mindedness	No.	8	49	38	136	25	230	13	363	146	5	24	182	11	122	1352
	%	10.8	9.6	43.2	58.4	22.1	83.9	50.0	64.4	30.4	5.2	19.8	66.7	32.3	98.4	44.9
Deaf mute	No.	28	37	5	10	26	16	5	387	165	2	56	172	12	117	1038
	%	37.8	7.3	5.7	4.3	23.0	5.8	19.2	68.7	34.3	2.1	46.3	63.0	35.3	94.4	34.5
Gait-defect	No.	16	53	9	18	43	15	7	23	95	6	16	117	5	27	450
	%	21.6	10.4	10.2	7.7	38.0	5.5	26.9	4.1	19.7	6.2	13.2	42.8	14.7	21.8	14.9
Squint	No.	2	184	2	9	23	22	3	14	39	6	6	33	8	18	369
	%	2.7	36.1	2.3	3.9	20.4	8.0	11.5	2.5	8.1	6.2	5.0	12.1	23.5	14.5	12.3
Stunted growth	No.	19	219	8	24	26	35	4	12	8	4	11	33	9	14	426
	%	25.7	42.9	9.0	10.3	23.0	12.8	15.3	2.1	1.7	4.1	9.0	12.1	26.5	11.3	14.1
Hypothyroidism	No.	4	452	36	133	6	25	4	45	45	82	51	35	10	5	933
	%	5.4	88.6	40.9	57.1	5.3	9.1	15.3	8.0	9.4	84.5	42.1	12.8	29.4	4.0	31.0
Total cretins		74	510	88	233	113	274	26	563	481	97	121	273	34	124	3011

Note : Column total not additive due to multiple responses

TABLE 3.14

Prevalence of goitre by type of population in study districts

Sl. No.	District	Goitre prevalence (%)			
		Non-tribal	Tribal	*Mixed village	Tea Estate
1.	Visakhapatnam	8.9	24.8	—	—
2.	Dibrugarh	—	69.1	66.4	45.2
3.	Muzaffarpur	33.7	—	—	—
4.	Sitamari	31.8	—	—	—
5.	Surat	8.6	24.7	—	—
6.	Mandla	46.6	33.4	—	—
7.	Dhule	6.7	25.9	—	—
8.	Central Manipur	10.3	4.3	10.7	—
9.	West Manipur	—	19.7	—	—
10.	Nilgiri	—	—	—	6.9
11.	Baharaich	20.2	—	—	—
12.	Basti	20.0	—	—	—
13.	Gorakhpur	18.6	—	—	—
14.	Mirzapur	5.4	7.2	20.0	—
	TOTAL	19.4	25.2	59.9	23.6

*Tribal and non-tribal mixed population.

TABLE 3.15

Prevalence of goitre by food habit in study districts

Sl. No.	District	Goitre (%) in population with food habit of					
		Wheat	Rice	Both Wheat & Rice	Maize	Millet	Others
1.	Visakhapatnam	17.4	—	—	13.4	—	—
2.	Dibrugarh	—	35.6	69.7	—	—	—
3.	Muzaffarpur	—	—	33.7	—	—	—
4.	Sitamari	—	—	31.8	—	—	—
5.	Surat	11.8	23.0	—	—	19.2	—
6.	Mandla	—	35.4	—	—	34.0	—
7.	Dhule	—	40.0	—	14.2	—	10.3
8.	Central Manipur	—	10.4	—	—	—	—
9.	West Manipur	—	19.8	—	—	—	—
10.	Nilgiri	—	6.9	—	—	—	—
11.	Baharaich	17.2	29.4	—	—	—	—
12.	Basti	27.4	13.9	—	—	—	—
13.	Gorakhpur	18.2	20.2	—	—	—	—
14.	Mirzapur	3.4	—	—	—	20.4	—
	TOTAL	18.3	29.9	32.4	13.7	20.2	10.3

TABLE 3.16

Prevalence of goitre by source of drinking water in study districts

Sl. No.	District	Prevalence of goitre (%) by source of drinking water						
		Sub-soil source			Surface source			
		Hand pump	Well	Both Well & Hand pump	River	Pond	Both Pond & River	Mixed
1.	Visakhapatnam	9.2	17.4	18.8	15.5	—	—	—
2.	Dibrugarh	32.6	—	66.1	—	—	—	5.2
3.	Muzaffarpur	—	—	33.7	—	—	—	—
4.	Sitamari	—	30.8	38.0	—	—	—	—
5.	Surat	—	19.4	—	28.3	—	—	—
6.	Mandla	—	—	29.9	—	—	—	34.5
7.	Dhule	19.4	14.5	14.9	12.4	40.0	49.6	4.1
8.	Central Manipur	—	—	—	—	6.9	10.6	—
9.	West Manipur	—	—	—	19.8	—	—	—
10.	Nilgiri	—	7.8	—	—	—	6.4	—
11.	Baharaich	--	8.5	21.1	—	—	—	—
12.	Basti	—	6.3	20.1	—	—	—	—
13.	Gorakhpur	7.3	—	23.0	—	—	—	—
14.	Mirzapur	—	5.2	7.2	—	—	—	7.2
	TOTAL	22.8	25.3	35.6	20.1	28.2	30.3	35.9

TABLE 4.01

Prevalence rate of goitre (%) by iodine content in drinking water source

Sl. No.	District	n	Prevalence of goitre (%)					
			Iodine content in water source (μg per litre)					
			<1	1–1.99	2–2.99	3–3.99	4–4.99	⩾5
1.	Visakhapatnam	179	28.2	22.4	22.9	—	—	9.7
2.	Sitamari	19	36.2	29.4	32.1	29.0	32.4	33.5
3.	Surat	39	31.3	22.0	18.0	—	36.2	15.0
4.	Dhule	41	31.2	49.6	—	—	16.2	7.5
5.	Nilgiri	5	6.0	10.2	—	59.2	—	—

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APPENDIX I

SUMMARY OF THE PROJECT MANUAL

1. OBJECTIVES OF THE STUDY

The aims of epidemiological surveys of goitre and endemic cretinism are:

1.1 To estimate the magnitude of the public health problem posed by the disease.

1.2 To compare the severity in a number of regions.

2. DEFINITIONS OF SIMPLE AND ENDEMIC GOITRE

2.1 Simple Goitre:

Anatomical enlargement of the thyroid gland without any functional alterations is called euthyroid or simple goitre. By convention it is regarded as a compensatory phenomenon which results when a single or a combination of factors interfere with the optimal formation of the hormones of the thyroid gland. Neoplastic growth is thus excluded from the purview of this definition

2.2 Endemic Goitre:

The prevalence of enlargement of the thyroid gland occuring in a significant number of people living in any circumscribed area is called endemic goitre.

2.3 Criteria for Endemicity:

Cases of enlargement of thyroid gland are found in all communities; even when there is an ample supply of iodine in the diet. Hence certain criteria have to be satisfied before designating an area as being endemic for goitre.

3. DEFINITION OF ENDEMIC CRETINISM (PAHO, 1974)

"The condition of endemic cretinism is defined by three major features".

3.1 Epidemiology:

It is associated with endemic goitre and severe iodine deficiency.

3.2 Clinical Manifestations:

These comprise mental deficiency, (Most, but not all observers include mental deficiency as an integral component of the definition of endemic cretinism) together with either:

3.2.1 A predominant neurological syndrome consisting of defects of hearing and speech and with characteristic disorders of stance and gait of varying degree; or

3.2.2 Predominant hypothyroidism and stunted growth. Although in some regions one of the two types may predominate, in other areas a mixture of the two syndromes will occur.

3.3 Prevention:

In areas where adequate correction of iodine deficiency has been achieved, endemic cretinism has been prevented.

4. TECHNIQUES FOR SURVEY

Two principal techniques are used for surveys

4.1 One consists in studying a selected population such as school children or army recruits;

4.2 and the other in studying entire population of villages, districts or other administrative units.

Advantages of survey of school children are that they:

(*i*) Require little preparation

(*ii*) Provide high participation rates.

(*iii*) Permit a good estimate of the prevalence of the disease in a fairly extensive region from which the pupils are drawn.

Their main drawback is that they cover a selected population from which the main attendant disabilities of endemic goitre i.e., cretinism, deaf-mutism, and other neurological defects are absent.

A W. H. O. study group in 1952 had recommended that school goitre survey results can be projected directly to the general population of the localities to which the surveyed schools belong. Our experience in the study areas of Uttar Pradesh & Bihar has been different. With the existing social practice prevailing in these villages, girls as a rule are not sent to the schools. Hence, we believe that in such areas, school goitre surveys cannot be representative of the population of the localities to which the surveyed schools belong.

Therefore, we suggest, that in assessing the problem of endemic goitre in suspected districts, a village should be taken as a unit of sampling. Studies of entire population, we know, are more difficult but they provide an opportunity of assessing the main attendant disabilities of endemic goitre e.g., cretinism, deafmutism frequencies in various groups, sexes, social categories, and geographical environments, and include cases of monstrous or multinodular goitre, collateral circulation and tracheal compressions rarely observed in schools. Here, we would like to make a suggestion that surveys might begin in schools and continue with complete population whenever more than 5% have grade I or when more than 30% of the school children are assigned to grade Ob or above.

5. CLASSIFICATION OF GOITRE IN EPIDEMIOLOGICAL SURVEYS

There are basically two types of goitre classifications : that which makes a quantitative estimate of the height, breadth, area or volume of the gland and which is mainly proposed for clinical practices or small surveys, and that which classifies thyroid enlargement into a small number of quantitative categories. Quantitative distributions of the thyroid enlargements characteristically observed in a population aid to avoid the loss of information inherent to any grouping into a few categories.

Classifications based on grading are the methods of choice for large population surveys because of their rapidity and simplicity.

We suggest the use of Stanbury's classification which is turn has been adopted from that first suggested by Perez et al. This is a practical classification and can be easily picked up even by the Community Health Guide (C.H.G.). It may be noted that grading of the thyroid gland is inherently subjective. The most important factors affecting the accuracy of estimations of goitre frequency are the variability of the observer's assessment over a period of time (intrao-beserver variability) and the variability among several observers (inter-observer variability), specially with reference to a palpable goitre. With an on-going training programme these errors can be minimized and controlled. It may be noted here that grade II enlargement of thyroid gland is the most readily reproducible indicator of grading of goitre, which eliminates the intra-observer as well as inter-observer variability.

6. STANBURY'S CLASSIFICATIONS FOR GRADING OF GOITRE

Grade Oa : Thyroid not palpable or if palpable, not larger than normal.

Grade Ob : Thyroid distinctly palpable but usually not visible with the head in a normal or raised position, considered to be definitely larger than normal, at least as large as the distal phalanx of the subject's thumb.

Grade I : Thyroid easily palpable and visible with the head in either a normal or a raised position. The presence of a discrete nodule qualifies a patient for inclusion in the grade.

Grade II : Thyroid easily visible with the head in a normal position.

Grade III : Goitre visible at a distance

Grade IV : Monstrous goitres

Thyroids of grade 'Ob' are abnormal by this classification but are probably of no particular pathological significance except as indicators of thyroid abnormalities in the community.

7. NODULARITY

In endemic areas, there are usually large number of persons who have nodules of varying sizes either within a gland of normal dimension or in a goitre. There may be only one nodule but in severely affected regions multiple nodules are frequently associated with marked hypertrophy of the gland. The presence of nodules is a clear indication of the severity of the endemia because it implies successive phases of tissue rearrangement resulting from prolonged action of iodine deficiency or other goitrogenic factors. The frequency of nodular goitre increases with age; they are usually observed among adults and elderly subjects, but in severe endemias, may be found in preadolescents. The presence of nodules introduces two complications into the classification of goitre for epidemiological purposes. Clinically, only the fairly large nodules (more than 10 mm in diameter) are easily detected by palpation. The frequency of nodules at autopsy is always higher than the clincal frequency. Thus the number of nodules palpated does not reflect the true situation, but rather depends on the firmness or softness of the surrounding thyroid. For the same degree of nodularity, different examiners record diverse frequencies, especially there is no international agreement on a definition of nodularity or the distinction between nodularity and local induration. The difficulty of evaluating nodular frequency is illustrated by the fact that an increase in frequency is observed after iodine prophylaxis, obviously, such an increase results from the fact that the nodules are more readily identifiable in the softer tissue and not from any worsening of the endemic situation.

8. TECHNIQUES OF GOITRE EXAMINATION IN EPIDEMIOLOGICAL SURVEYS

For the epidemiologist, the aim of the thyroid examination is to estimate the scale of public health problem posed by the disease on the basis of an evaluation of goitre frequency in well defined groups. This approach, the object of which is to obtain reproducible estimates, is very different from the approach of the endocrinologist who must carefully consider every possible anomaly of a thyroid gland prior to making a diagnosis and deciding on treatment. Examination by the epidemiologist must be rapid and include standardized methods of inspection and palpation. Estimation of volume is too subjective and too time consuming. The only practical approach is to group the different degrees of hypertrophy into small number of categories based on arbitrary classifications. We suggest, the following circumstances of the examination. The subject starts walking towards the examiner from a line marked at a distance of approximately 2 metres. This enables the examiner to have a look at his gait, body proportion and the enlarged gland, if any i.e. (Grade III & IV).

The subject stops walking and faces the examiner at a close distance with the front of subject's neck well exposed to light. The presence of visible goitre is detected straight away with the neck in normal position (Grade II). The subject is then requested to extend his neck and asked to swallow which helps to note the visible enlargement of the thyroid (Grade I). The thyroid gland is then palpated by the examiner with the subject turning his back to the examiner; either in a standing or a sitting position. The palpation confirms

and supplements the result of the inspection. The consistency and nodularity of the gland are assessed by the four fingers of the examiner with hands along the trachea.

Very young children are examined in supine position. The examiner raises the child slightly by placing his left hand under the shoulder blades, with the child's head resting on the examining table. The examiner then palpates the thyroid areas with his right forefinger.

9. CLASSIFICATION OF GOITRE ENDEMICS ACCORDING TO SEVERITY

Non-toxic sporadic goitre is present in all populations, and from the clinical, physiopathological and anatomical points of view endemic and sporadic goitre are entirely similar. Thus, the existence of endemicity has to be based only on statistical criteria, i.e. a threshold of goitre frequency above which the disease is regarded as endemic in a well defined geographic area. In the definition of this threshold, one must take into account the fact that it is generally considered that the presence of thyroid hypertrophy or small diffuse goitre is physiological in about 4% of young girls at puberty.

9.1 Stanbury's Criteria

Epidemiological Criteria

Endemic goitre would be considered to exist.

(*a*) When more than 5 per cent of an adolescent or preadolescent group have "Grade 1" goitre or,

(*b*) When more than 30 per cent are assigned to 'Grade Ob' or above.

This decision would be reinforced if it could be shown in a fair sample of the population that the mean daily excretion of iodine in the urine is:

(*a*) Less than 50 μg per 24 hours, or,

(*b*) Less than 50 μg per gram of creatinine, in randomly obtained specimens.

10. TECHNIQUES FOR DETECTION OF ENDEMIC CRETINISM IN EPIDEMIOLOGICAL SURVEYS

NOTE: 'In a field survey, how can a cretin be traced and identified?

By the PAHO definition the best that can be done is to enumerate :

(1) All subjects who are deaf-mutes

(2) Those who are obviously mentally retarded according to the standards of the community.

(3) Those who have spastic diplegia of the lower extremities with exaggerated reflexes

and positive Babinski leading to grossly disordered locomotion & other motor disabilities.

(4) Squint

(5) Stunted growth (Dwarfism)

(6) Clinical features of hypothyroidism such as pallor, puffiness of face, coarse and thickened skin, delayed relaxation of tendon jerks, sluggishness and lethargy and myxoedema.

For operational purposes all these defects can be used to identify a cretin. Thus, any individual belonging to an endemic goitrous community, with one or more of the abnormalities described above can be counted as an endemic cretin.

If 20% of the population in a community has a thyroid enlargement of Grade 1 or above, then, the persons who have the classical clinical attributes of this syndrome will be encountered. The experience of AIIMS team over the course of last several years has shown that if 20% of the population i.e., both sexes, age groups 10 years to 19 years have Grade II or above enlargement of the thyroid gland, then there is significant prevalence of endemic cretinism in such population.

COLLECTION OF URINE SAMPLES

Casual urine sample about 20 to 70 ml has to be collected in 100 ml capacity screw capped wide mouth plastic bottle with well fitting inner lid. After collection of urine sample enough toluene (A. R. grade B.D.H.) should be added so as to make a complete layer over the urine sample. This should be sent to the Laboratory with instruction that creatinine should be estimated as early as possible. Creatinine estimation of the urine sample collected may be done in local Medical College (method enclosed) and individual values recorded. The values should be sent along with urine samples to Iodine Monitoring Laboratories at All India Institute of Medical Sciences or National Institute of Nutrition as the case may be. Urine samples should be collected at appropriate intervals preferably at the time of completion of survey in a given village. The persons from whom urine should be collected should be ear-marked during the survey and all samples collected at the end of survey. These samples are then despatched to the Medical College or to Iodine Monitoring Laboratories at A. I. I. M. S. or N. I. N. as the case may be. It is emphasized that time interval between collection of urine and its arrival in the laboratory should not be more than a week. For sample identification appropriate numbers such as PHC, village and sample number should be marked on the bottle. For numbering, a small piece of leukoplast should be pasted on the bottle and lead pencil is used to write on this.

COLLECTION OF WATER SAMPLES

100 ml of drinking water from every available source in the village should be collected in iodine free bottle, appropriately labelled and sent to the Laboratories for iodine estimation. Samples may be sent to Laboratory at suitable intervals.

INDIAN COUNCIL OF MEDICAL RESEARCH

Multicentre Study On Prevalence Of Goitre And Associated Health Consequences

HOUSEHOLD PROFORMA

NAME OF THE HEAD OF HOUSEHOLD :.....

(1—5) I. C. M. R. JOB NO. □□□□□

(6—7) CENTRE □□

(8) DISTRICT □

(9—10) P. H. C. □□

(11—12) VILLAGE □□

(13—15) HOUSEHOLD NO. □□□

(16—17) TOTAL FAMILY MEMBERS □□

(18—19) NO. OF GOITRE CASES IN THE FAMILY □□

(20) OCCUPATION OF HEAD OF THE HOUSEHOLD □

1. Agriculture
2. Landless Labourer
3. Artisan
4. Business
5. Service
6. Others..... .....

DETAILS OF FAMILY MEMBERS

Member No.	Sex 1. Male 2. Female	Age (yrs)	Goitre 1. No 2.Yes	Grade 1. ob 2.I 3.II 4.III 5. IV	Nodule 1. No 2. Yes	Feeble mindedness 1. No 2. Yes	Deaf-mutism 1. No 2. Yes	Gait defects 1. No 2. Yes	Squint 1. No 2. Yes	Stunted growth 1. No 2. Yes	Hypo-thyroidism 1. No 2. Yes	Urine sample No.
(21-22)	(23)	(24-25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35-38)
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APPENDIX II

COLLABORATING CENTRES

Sl. No.	Centre	State	Principal Investigator
1.	Assam Medical College, Dibrugarh	Assam	Dr. F.U. Ahmed
2.	S.S. Medical College Rewa	Madhya Pradesh	Dr. M.P. Dwivedi
3.	Govt. Medical College, Aurangabad	Maharastra	Dr. P.V. Sathe
4.	King George's Medical College, Lucknow	Uttar Pradesh	Dr. B.C. Srivastava (Late)
5.	Patna Medical College, Patna	Bihar	Dr. Suryabhushan
6.	Govt. Medical College, Surat	Gujarat	Dr. V.K. Desai
7.	Andhra Medical College, Visakhapatnam	Andhra Pradesh	Dr. B. Swarajyalakshmi
8.	Regional Medical College, Imphal	Manipur	Dr. E.Y. Singh
9.	St. John's Medical College, Bangalore	Karnataka	Dr. C.B. Sridhar Dr V. Rahamathullah

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CO-ORDINATORS

Sl. No.	Institution	States	Co-ordinators
1.	All India Institute of Medical Sciences, New Delhi	Assam, Bihar, Uttar Pradesh, Manipur, Madhya Pradesh	1. Dr. N. Kochupillai 2. Dr. M.G. Karmarkar
2.	National Institute of Nutrition, Hyderabad	Andhra Pradesh, Gujarat, Tamilnadu, Maharastra	1. Dr. K.A.V.R. Krishnamachari
3.	Central Co-ordinating Unit, Division of Human Resource Development Research, Indian Council of Medical Research, New Delhi	Overall Co-ordinator	1. Dr. B.N. Saxena 2. Dr. K. Bagchi 3. Mr. N.C. Saxena 4. Dr. U. Kapil 5. Dr. R. Mittal 6. Mrs. J. Dasgupta 7. Dr. A. Fotedar 8. Mr. B.S. Dhillon 9. Mr. P. K. Ghosh 10. Mrs Tapasi Tat 11. Mr. R.S. Malik